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Abstract

RADIOCHEMICAL INVESTIGATIONS AND CHEMICAL RESEARCH ASSOCIATED TO NUCLEAR REACTORS IN BRAZIL

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A report on radiochemical investigations and chemical research associated to nuclear reactors in three major Brazilian centres is presented.

A brief survey of chemical work associated to radioactivity carried out in Brazil prior to the installation of research reactors in this country is reviewed.

Radiochemical investigations started as a result of development of Nuclear Physics with the installation of several machines such as a 30 Mev betatron, 4 Mev Van de Graaf and 1 Mev Cockroft-Walton. The installation of nuclear reactors sited at S. Paulo (5 Mw swimming-pool) and Belo Horizonte (Mark I Triga Reactor) entailed new possibilities for research.

Radiochemical research in the Centro Brasileiro de Pesquisas Físicas has covered and is progressing along the following lines: investigation on the production of radioelements in the atmosphere by cosmic ray induced nuclear reactions, physico-chemical investigations with radioisotopes such as complex formation in solutions of lanthanides and actinides, the electrochemistry of tracers, and, more recently, studies on molecular structure by the Mossbauer Effect.

The installation of the 5 Mw swimming-pool reactor in the Instituto de Energia Atômica, S. Paulo, lead to a series of works connected, at first, with the construction and assembling of the machine. For about two years, work was carried out along service-function lines such as maintenance and correlated

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problems on the general areas requiring chemical competence. Later on, with the construction of appropriate laboratory facilities, work developed along the main line of production of nuclear grade fissile material, using tracer techniques for the development of analytical methods, and of radioisotope production in research reactor.

At the same time research work was conducted, mainly, in the analytical radiochemistry field with the development of methods which had to be used for the analysis of nuclear grade materials such as uranium, graphite, beryllium, rare-earths elements, as well as for minerals concerning their contents for gold, uranium, niobium, tantalum and elements present in low concentration.

Activation analysis and isotope dilution analytical procedures were worked out and applied for the solution of the above purely chemical problems.

On a latter stage, efforts were devoted to the analytical steps of application of radioisotopes to technology, hydrology and chemical fabrication of organic compounds.

Research is now being conducted on short-lived radioisotopes by association of instrumental techniques and fast radiochemical separations such as focusing ion exchanger and focusing electrophoresis.

The addition of a Triga Reactor to the Instituto de Pesquisas Radioativas, Belo Horizonte, together with radiation chemistry facilities allowed for the development of new radiochemical-research lines in that Centre. Prior to the reactor installation, research on chemical problems was carried out mainly on the analysis of minerals and on fall-out. Present research is being conducted in radiation chemistry with emphasis on the development of high dose dosimeters (neutron and gamma), and generally on the chemical consequences on nuclear transformations in solids and liquids. Tracer applications to some industrial problems such as the transport of minerals in pipe lines and on the extractive metallurgy of niobium and beryllium are being conducted. Activation analysis of samples of geological and industrial materials is now being made on a routine basis.

A survey of the Brazilian bibliography on radiochemistry is presented. The current research work is discussed together with a presentation of existing facilities in the country.